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SOCIAL-CLASS, RACE, SEX AND SERIATING--A STUDY OF THEIR RELATIONSHIP AT THE KINDERGARTEN LEVEL. FINAL REPORT.

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DESCRIPTORS- *SOCIAL CLASS, RACE, SEX DIFFERENCES, *SERIAL ORDERING, *KINDERGARTEN CHILDREN, *PERCEPTUAL DEVELOPMENT, NEGRO STUDENTS, LEARNING READINESS, *READING READINESS TESTS, MINNESOTA READING READINESS TEST

THIS EXPERIMENT WAS CONCERNED WITH ASSESSING THE RELATIONSHIPS BETWEEN SKILL IN SERIATING AND VARIOUS MEASURES YIELDED BY THE METROPOLITAN READING READINESS TEST (RRT). ANOTHER OBJECTIVE WAS TO EVALUATE THE EXTENT TO WHICH SKILL IN SERIATING IS ASSOCIATED WITH SOCIAL CLASS, SEX, AND RACE. THE AUTHORS CONSTRUCTED A SERIATION TEST WITH AN ESTIMATED MENTAL AGE RANGE OF THREE AND ONE-HALF TO SEVEN YEARS, AND ADMINISTERED IT TO KINDERGARTENERS. RESULTS INDICATED THAT--(1) SERIATION SCORES ARE STABLE, (2) SERIATION SCORES DO NOT CORRELATE MORE HIGHLY WITH MRRT (NUMBER READINESS) THAN WITH MRRT (READING READINESS), AND (3) SERIATION SCORES OF WHITES ARE HIGHER THAN THOSE OF THE NEGROES. NO SIGNIFICANT SOCIAL-CLASS DIFFERENCES WERE FOUND. SKILL IN SERIATING WAS NOT NECESSARILY ASSOCIATED WITH SEX. IT IS SUGGESTED THAT SIGNIFICANT EDUCATIONAL PROBLEMS EXIST WHEN CHILDREN ENTER KINDERGARTEN, AND THREE IMPORTANT FOLLOW-UP STEPS ARE SUGGESTED. (PH)

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5. Introduction

Inhelder and Piaget (1964) have postulated that the cognitive processes of seriation and classification[1] provide important clues concerning the early beginnings of intelligence. While language appears more closely associated with classification, and perception with seriation, they argue that significant parallelisms, marked by similar turning points, characterize the growth of skill in classifying and seriating (Ibid, p. 290). If their theory is correct, then seriation scores would correlate highly with language weighted tests, such as the subtests which are included in the Metropolitan Reading Readiness Test--Reading Readiness (MRRT-RR). The formulations of Thurstone (1938, 1947), however, suggest that seriation scores would correlate much more highly with number facility than with language measures. The content of a number of instruments, including the Science Research Associates - Primary Mental Abilities (SRA-PMA) and the Wechsler Preschool and Primary Scale of Intelligence (WPPSI), suggest that seriation tasks are more relevant to number facility than to classification or language development.

If at the kindergarten level a close association exists between ability to seriate and classify, or between language and perceptual development, then it is possible that seriation may provide a significant pathway to facilitation of young children's general learning readiness. It is of some interest to note that while a number of theorists, while using different terms, agree on the importance of a young child overlearning basic perceptual systems (seriation) before conditions can be considered ripe for growth of verbal learning. Thus Tyler (1956) documents the early perceptual defect of many culturally deprived children and hypothesizes that often this contributes to development of irreversible language deficit. Remondino (1962) speaks of simple overlearned symbolic systems; Cattell (1966) draws a distinction between fluid and crystallized intelligence; Wohlwill (1962) and Elkind, et al (1962) emphasize the importance of the child being able to gradually decrease dependence on information from the immediate stimulus field.

The experiment which is reported here was primarily concerned with assessing the relationships between skill in seriation and various measures yielded by the MRRT. Another experimental objective was to evaluate the extent to which skill in seriating is associated with social class, sex and race.

Experimental hypotheses were that (1) seriation scores will be reliable (2) total seriation scores will be significantly correlated with total MRRT scores (3) the correlations of seriation and MRRT (Number Readiness), and seriation and MRRT (RR) scores will be approximately the same (4) Negro children will obtain significantly lower seriation scores than white children (5) lower-class children will obtain significantly lower seriation scores than middle-class children.

If the hypotheses of this experiment were sustained, a second experiment was planned. This experiment would provide late kindergarten seriation enrichment to determine the effect of such enrichment on children's readiness for learning. This projected experiment would follow Ss through fourth grade. Ss kindergarten seriation scores and later attainments on achievement measures (routinely administered by regular school personnel) would be periodically compared. In this manner the longitudinal effect of seriation enrichment, as well as the extent to which skill in seriation predicts proficiency in one of a combination of academic spheres, would be assessed.

6. Method

Subjects: Ss were all the 356 kindergarten students of target schools which were selected so that social-class and racial differences could be assessed. Using census tract of residence (Brunsman, et al, 1961) as a general criterion of social-status, and drawing upon statistics concerning schools' racial composition, four Waterloo, Iowa, public elementary schools were selected as being representative of segregated and integrated, as well as lower- and middle-class schools. Upper class schools were excluded from the study. School 1 is lower-class Negro, segregated. Only a handful of white children are "bussed in." School 2 is lower-class and integrated; 70% of the school population is Negro. The area served by School 2 is undergoing a change in racial composition with whites moving out and Negroes moving in. School 3 is middle-class integrated; 30% of its students are Negro. School 4 is segregated, white, and middle-class.

Insert Table 1 about here

Instruments: Using the mental age norms of such instruments as the Stanford-Binet (LM) and Leiter International Performance Scale as a rough guideline, the authors constructed a seriation test with an estimated mental age range of three and one half to seven years. This seriation test has two subtest scales, trial-error

and operational. On trial and error tasks, Ss are permitted to manipulate illustrated cutouts and paste them on the record booklet. Operational tasks require the Ss to designate, with a pencil, a response on the record booklet.

Procedures: While the classroom teacher arranged activities outside the classroom for half the children, three college trained adults administered the seriation test to the remaining kindergarteners. Cardboard dividers were used to assure that each child worked independently. No emphasis was given to speed: the children were encouraged to take as much time as they wished.

Two weeks after the seriation test was administered, Ss were given the MRRT as part of established testing procedures in the Waterloo schools.

Reliability measures were obtained by retesting two classes of kindergarten students in School 1. In addition, two classes of students of a white segregated lower-class school in Cedar Falls, Iowa, were tested and then retested after a two week interval.

Insert Table 2 about here

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7. Results

Table 3 summarizes the means and standard deviations of the MRRT and seriation test, while Table 4 illustrates the total seriation scores, by social class and by race.

Insert Table 3 about here

Insert Table 4 about here

Results of the analysis of variance, using as variables total seriation scores, social class and race are listed on Table 5.

Insert Table 5 about here

On Table 6, key correlations of the experiment are cited. The experimental variables are: Variable 1, Trial and Error Seriation; 2, Operational Seriation; 3, Full Scale Seriation; 4, Rank Order, Total Seriation Scores; 5, Rank Order, Teacher Rating of Students' General Intellectual Capabilities; 6, Rank Order, Total MRRT; 7, Word Meaning, MRRT: 8, Sentences, MRRT: 9, Information, MRRT: 10, Matching, MRRT: 11, MRRT-RR; 12, MRRT-Number Readiness; 13, MRRT, Copying; 14, MRRT-Total Score.

Insert Table 6 about here

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8. Discussion

It has been mentioned that reliability measures (Table 2) concerning the stability of the seriation instrument were obtained only with lower-class Ss. Scheduling problems required a postponement of reliability testing with middle-class Ss. We have, however, no basis for believing that there is any systematic reason why reliability coefficients of the seriation test might be lower with middle-class Ss. While Table 3 provides only raw data, it is of interest that in comparing raw scores of the MRRT and seriation test, there is a tendency for white Ss to obtain somewhat higher scores on the seriation test, while Negro Ss secure slightly higher scores on the MRRT. It is noteworthy that in general larger standard deviations are secured on the seriation test; greater dispersion on both instruments is observed with Negro Ss. The dispersion pattern would justify exploration into the possibility that many children regardless of race, but especially Negro children, do not have, within their homes, the type of educational games and toys which facilitate skill development in seriation, such as hollow blocks and seriating rings.

Table 4 reveals that there is a narrow range of mean seriation scores within race but wide differences between race. It is also noted that the mean seriation score for low class white Ss is higher than the mean seriation score of middle-class Negro Ss. As Table 5 indicates, analysis of variance yielded statistically significant differences between-race but not on the variables of social-class and interaction (race x social-class). Apparently wide between-race, and narrow within-race, differences noted in Table 4

are responsible for this unexpected finding. What appears to have happened is that within the schools there was such a wide difference between races that no social class differences emerged. This was a surprising finding, in view of the evidence (Table 1) that the pairings of schools on the basis of social-class appears to have been fully justified. The wide racial and small social class differences suggest that Negro children do require early enrichment and remediation which stresses perceptual skill, something which Tyler (1956) has suggested. Another implication of this finding is related to Bloom's (1964) conclusion that 50% of a child's intellectual development takes place between conception and age four. The data of this study suggest that the schools can hardly hope to succeed in overcoming the effects of deprivation if they wait until Negro children are even four or five years old before they begin enrichment intervention.

Table 6 illustrates the correlations of the three seriation scores with other experimental variables. The correlation between total MRRT and seriation scores is .82, which compares well with other stability coefficients which have been reported (Cronbach, 1960, pp. 115-120). Correlations between the MRRT and the Trial-Error subtest are lower than MRRT correlations with the Operational subtest; in general, the patterning of correlations indicates that the Operational subtest appears to be more closely associated with MRRT variables, as well as with teacher estimates of pupils' general ability, than is the Trial-Error subtest. The data do not, however, speak to the question as to whether early enrichment in seriation should initially stress trial and error problem solving. Such a strategy would, however, be consistent with Wohlwill (1962) and Elkind's (1962) emphasis on the tendency for children to move from an initial dependence on concrete, tactual stimuli to a gradually diminishing reliance on stimuli which can be manipulated.

All three seriation scores correlate more highly with the MRRT-RR than with MRRT-NR, a finding which supports Piaget and Inhelder's position (1964) that perceptual and language functions are more closely associated than is often assumed. As far as this report is concerned, however, such a conclusion would have to be limited to a consideration of kindergarten Ss and cognitive operations which are characteristic of children of this developmental stage. An evaluation of various MRRT subtest correlations with the total seriation score reveals that one subtest of MRRT (RR), matching, is more closely associated with seriation than are other MRRT-RR subtests. This raises the question as to whether matching should be classified as a MRRT-RR or a MRRT-NR subtest. Phrased differently, we can ask if matching tasks are loaded more heavily in language or in perceptual functions or indeed if we can even make such a distinction. This is a debatable question and one which raises a

clear implication: it is difficult to construct an instrument for five to six year old children which does not contain significant content overlap when classification and seriation constructs are employed.

In sum, it was predicted that seriation scores would be reliable. It was also predicted that total seriation scores would be significantly related with total MRRT scores: the obtained correlation of .82 appears to fully sustain this hypothesis. Hypothesis 3 posited that there would be little difference in the correlation of total seriation scores with MRRT-RR and with MRRT (NR): this hypothesis was also sustained. A two-way analysis of variance indicated that there was a statistically significant difference between Negro and white Ss using seriation scores as a criterion. However, contrary to prediction, there was no statistically significant difference between the low and middle-class groups using the same criterion. It has been suggested that the statistically insignificant social-class findings are associated with substantial racial differences which were found within social-class. On the basis of this experiment it appears that social-class indices of an integrated school neighborhood, at least in Waterloo, tell us little about the level of readiness for learning of Negro and white children who are entering kindergarten.

9. Conclusions, Implications and Recommendations

The results reported here suggest that, at least in Waterloo, when kindergarten children attend an integrated school the within-classroom dispersion of readiness is increased. This prompts questions for which we at present have no answer: what impact does such wide within-classroom dispersion of readiness for learning have upon children's subsequent learning as well as their motivation for continuing to learn? Do the effects vary according to the child's relative level of readiness when he enters kindergarten? Do we have here a suggestion that, at least in integrated lower elementary classrooms, we must have a lower teacher-pupil ratio so that more individualized activities can be arranged in small groups?

Findings of this experiment suggest that for many children early enrichment must be provided before the children enter kindergarten. The relatively low scores of many Ss, when viewed in the context of Bloom's (1964) evidence that 50% of cognitive development is determined by age four, indicates that there is an urgent need to examine enrichment procedures for very young children. Certainly it would be interesting to know whether seriation rings (Fisher-Price 927) or hollow blocks are available in the homes of

the disadvantaged children who come to kindergarten so woefully unprepared. The high degree of association found between language (MRRT) and perceptual (seriation) types of problem solving suggests that important and general educational results might be effected if children are helped to develop perceptual skills through purposive seriation play which may, in turn, facilitate growth of overall operational thought. Some justification for this idea is advanced in the theoretical discussion concerning the important interactive behavior of classification and seriation (Inhelder and Piaget, 1964, p. 290).

For this reason a follow-up experiment appears to be of utmost importance. The writer suggests that this follow-up study would provide seriation enrichment in late kindergarten for lower-class children. In such a follow-up study, experimental and control Ss would be matched for C.A., social-class, race, IQ, and sex. Ss would be followed through fourth grade. The original (kindergarten) seriation scores and Ss later attainments on achievement measures (routinely administered by regular school personnel) would be periodically compared. In this manner the extent to which skill in seriation predicts proficiency in one or a combination of academic spheres would be determined.

10. Summary

This study has examined the relationships, at the kindergarten level, of the following variables: seriating skill, race, sex and social class. Ss consisted of the kindergarten populations of four Waterloo, Iowa, schools which were selected on the basis of social class and racial composition. It was predicted that seriation scores would be stable and that they would be highly correlated with reading readiness measures (Metropolitan Reading Readiness Test: MRRT). In view of Inhelder and Piaget's (1964) postulation that there are important interactive aspects of classification and seriation in the development of operational thought, it was also predicted that, contrary to Thurstone's formulations (1938, 1947), the MRRT-Number Readiness subtest would not correlate more highly with seriation tasks than would MRRT-Reading Readiness measures. It was also predicted that seriation scores would be significantly higher for white than for Negro Ss, and for middle-class than for lower-class Ss.

As predicted, results indicated that seriation scores are stable, that seriation scores do not correlate more highly with MRRT-NR than with MRRT-RR, and that seriation scores of whites are higher than those of Negroes. Contrary to prediction, no significant social-class differences obtained. No hypothesis was made conderning sex but the data suggests that skill in seriating is not significantly associated with this variable. The pattern of experi-

mental findings suggests that significant educational problems exist by the time children enter kindergarten and that these followup steps, which have been considered in the test of this report, should be considered (1) explore the implications that within an integrated classroom, at least in Waterloo, there is a wider dispersion of children's measured readiness to learn, (2) experimentally implement early enrichment activities for very young (18-24 months) children, using seriation educational toys as a vehicle for facilitation of general learning readiness. This suggestion is made because of the writer's observation concerning the seriation (play) activities of his 18 month old daughter, and (3) determine through experimentation the longitudinal effects with lower-class Ss of specific seriation enrichment in late kindergarten.

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FOOTNOTES

[1]Throughout this paper seriation refers to ordering by size or orientation of object such as from smallest to largest or repeating the sequence of a pattern; classification refers to placing into categories such as all big balls or all red balls, all vegetables.

Table 1

Social Class Data

Characteristic	School 1	School 2	School 3	School 4
Median School Years Completed	8.5	10.1	11.2	12.4
% Male Labor Force Unemployed	15	13	6	6
Median Family Income	$ 5,566	$ 6,200	$ 6,346	$ 7,192
% Families with income under $3000.00	23	16	10	7
Assessed Value of Home	$ 7,700	$ 9,700	$11,400	$13,200
% Owner Occupied Households	69	80	83	84
% Houses in Deteriorating or Dilapidated Condition	42	18	10	8

Table 2

Reliability of Total Seriation Scores

		Stability Coefficient
Negro Lower Class	(N=.46)	.91
White Lower Class	(N= 41)	.945

Table 3

Means and Standard Deviations of Total MRRT and

Total Seriation Test

	Total	All girls	All boys	Negro boys	White boys	Negro girls	White girls	All White	All Negro
MRRT	72.5 15.5	73.45 14.95	71.545 16.01	62.86 15.5	78.8 12.4	64.05 15.2	81.41 8.91	80.15 7.08	63.48 11.45
SERIATION	74.41 20.84	74.95 20.49	73.84 21.10	62.09 19.98	84.16 16.05	62.95 19.51	85.59 14.62	84.90 15.35	62.54 19.84

Table 4

Total Seriation Scores--Variables: Social-Class and Race

	Lower Class		Middle Class	
	School 1 (Negro segregated)	School 2 (Integrated)	School 3 (Integrated)	School 4 (White segregated)
WHITE	72.8#	85.1	84.6	85.6
NEGRO	60.2	64.8	63.7	--

#Total white population of School 1 consists of twelve kindergarten Ss who are bussed.

Table 5

Analysis of Variance: Seriation Scores, Social-Class, and Race

	ss	df	ms	f
Column Means (social-class)	720.36	1	720.36	2.24
Raw Means (race)	18425.65	1	18425.65	57.24**
Interaction	158.88	1	158.88	.493
Within	42494.23	132	321.92	
Total	61799.12	135		

N, each cell, 34 (one total and three randomized populations)

** p,.01

Table 6

Product-Moment Correlations of Trial-Error Seriation Scores with Other Experimental Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Trial-Error Seriation	.--	.72	.87	.69	.45	.58	.51	.45	.48	.66	.66	.59	.58	.71
Operational Seriation	.72	.--	.95	.81	.57	.67	.58	.48	.57	.68	.72	.67	.63	.79
Total Seriation	.87	.95	.--	.83	.57	.70	.61	.53	.59	.73	.77	.69	.66	.82